REMARKS

As part of this Amendment, Applicants are submitting a Substitute Abstract, which is a single paragraph. In light thereof, it is respectfully submitted that the objection to the Abstract, set forth in Item 2 on page 2 of the Office Action mailed September 26, 2001, is moot, and the required correction has been made.

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, each of claims 1-5 has been amended to recite a high strength Mg based "casting" alloy; spelling of "rare-earth" in each of claims 9 and 10 has been corrected; and claim 11 has been amended, to be dependent on any one of claims 1 to 8. Moreover, the independent claims, claims 1-8, have each been amended to clarify that the various ranges for each of the components of the alloy is a percentage "by weight"; and amounts of Al and of Sn in various of the claims have been amended, consistent with the description in Applicants' original disclosure, including the alloys set forth in the graphs.

Applicants have also added new claims 22-26 to the application. Claims 22 and 23 expressly set forth the subject matter set forth in claim 11, but are respectively dependent on claims 9 and 10. Claims 22 and 23, have been added in light of amendments to claim 11 to avoid a multiple dependent claim which is dependent on, <u>inter alia</u>, multiply dependent claims. Claims 24 and 25,

dependent respectively on claim 1 or 2 and on any one of claims 1-3, 6 and 7, respectively further defines amount of aluminum in the alloy and further defines amount of tin in the alloy. Claim 26, dependent on any one of claims 1, 2, 6 and 7, recites that the alloy includes 12%-17% Al. In connection with the newly added claims, note, for example, pages 7 and 8 of Applicants' specification.

The undersigned notes Applicants' election of the Group I claims, in the Response submitted July 13, 2001 in connection with the above-identified application. In addition to previously considered claims 1-11, it is respectfully submitted that newly added claims 22-26 also read on the elected Group I claims, and are to be considered on the merits in the above-identified application.

Objection to claim 11 as being in improper form, set forth in Item 3 on page 2 of the Office Action mailed September 26, 2001, is noted. The dependency of claim 11 has been amended, such that claim 11 is only dependent on any one of claims 1 to 8 (each of claims 1 to 8 being an independent claim). In light of amendment of the dependency of claim 11, it is respectfully submitted that the objection thereto is moot.

Applicants respectfully submit that all of the claims now presented for consideration by the Examiner patentably distinguish over the teachings of the references as applied by the Examiner in rejecting the claims previously in the application, that is, the teachings of the U.S. patents to Schulz, et al., No. 5,964,965, to King, et al., No. 4,332,864, and to Gitlesen, No. 3,653,880, Great

Britain Patent No. 1,291,553, and the Abstracts of SU241679, the journal article by Drits (IMV 2-1), the conference by Drits, SU447452, JP2-47238, DE No. 1301914, and NO20675, under the provisions of 35 USC 102 and 35 USC 103.

In general, it is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a Mg-based casting alloy as in the present claims, having the recited amounts of, inter alia, aluminum, tin and zinc, and advantages achieved by these recited alloys as casting alloys.

The present invention is directed to novel Mg casting alloys, which can be effectively utilized for die casting and injection molding, useful for various products.

Various casting Mg alloys, such as AZ91D, have been utilized. However, with the growing need for relatively thin products, and high precision of, e.g., cast parts, to reduce weight and size of portable devices, high fluidity alloys have been required. The fluidity may be improved by raising the temperature of the molten alloy; however, raising the molten alloy temperature has problems in oxidation of the molten alloy and in shortening durable lifetime of machines used in producing parts made of the alloy. Therefore, it is necessary to improve fluidity by other methods. See the last full paragraph on page 2 of Applicants' specification.

Against this background, Applicants provide a magnesium alloy, whereby

by including appropriate amounts of Al, Sn and Zn to the magnesium alloy, melting point of the alloy is lowered and fluidity is improved. Thus, the present alloy, having specific amounts of, e.g., aluminum and tin (or aluminum, tin and zinc) has high strength, with decreased melting point and improved fluidity.

As described on pages 6 and 7 of Applicants' specification, the magnesium alloys in accordance with the present invention are improved in fluidity due to lowering of the melting point, particularly by adding a small amount of Sn to the Mg-based alloy containing Al, and, accordingly, members having less surface defects can be obtained. Moreover, since low temperature molding can be performed and accordingly contraction at solidifying is small, members having a high dimensional accuracy can be obtained, and the molding yield can be improved. In addition, since the load on the injection machines, for example, the cylinder of an injection molding machine or the like, is decreased, durable lifetime of the machine can be lengthened. Furthermore, the magnesium alloys in accordance with the present invention are good in mechanical properties and corrosion resistance, because of the homogenous and fine microstructure. See also the paragraph bridging pages 27 and 28, and first full paragraph on page 28, of Applicants' specification.

Furthermore, attention is respectfully directed to Figs. 5 and 6 of the present disclosure, which shows that by adding Sn to the alloy No. 11, which corresponds to a conventional alloy in the AZ91D alloy family, hardness is

increased, and tensile strength of the alloy increases to a remarkable extent. Amount of tin added should be 10% or less, in order to avoid disadvantageous decrease in elongation rate as shown in Fig. 7 of the present disclosure.

Attention is also respectfully directed to the enclosed Figure, which shows relationships between elongation and tensile strength in Mg alloys, with data additions of conventional alloy No. 11 and AZ91D to Fig. 12 of the present disclosure. As can be seen in the enclosed Figure, an aluminum content of 10% or more in the alloy according to the present invention provides higher tensile strength. Further, since the alloy contains Sn in an amount of more than 0.5%, molten-flow performance of the alloy is high; this means that the alloy is highly useful as a Mg alloy for die casting and injection molding. While the high content of aluminum may decrease elongation, the alloy according to the present invention still provides an elongation of 1% or more, as stated in Applicants' specification, which is adequate for practical use.

In the following is provided a listing of the applied references and the teachings thereof, including a description of the alloy described therein.

(1) SU 241679 describes a Mg alloy having high plastic workability, wherein the alloy contains 4 to 6% of Al, 7 to 9% of Li, 2 to 4% of Sn, 0.8 to 2% of Zn, and 0.15 to 0.5% of Mn.

(2) SU 447452 describes a Mg alloy having stable mechanical properties given by adding Sn, wherein said alloy contains 3.5 to 4.5% of Al, 1 to 2% of

Zn, 0.3 to 0.5% of Mn, 0.2 to 0.8% of misch metal, and 0.3 to 0.8% of Sn.

(3) USP 4,332,864 describes a Mg alloy for the anode in a primary battery, wherein the alloy contains 1 to 9% of Al, 0 to 4% of Zn, 0.1 to 5% of Sn, and 0 to 1% of Mn.

(4) JP 02047238 describes a vibration-damping Mg alloy, wherein this alloy contains 0.1 to 10% of at least one of elements selected from a group of Al, Si, P, Ca, Mn, Zn and Sn.

(5) DE 1301914 describes a Mg alloy having improved strength at high temperatures, wherein the alloy contains 10% or less of Al, 7% of less of Zn, 1% or less of Mn, and 5% or less of Sn.

(6) NO 20675 describes a Mg alloy having improved strength at 200°C, wherein the alloy contains 10% or less of Al, 7% or less of Zn, 2% or less of Mn, and 5% or less of Sn. The alloys can also include 0.5-5% rare-earth metals and 0.2-3% Si.

(7) GB 1291553 describes a casting Mg alloy produced by die casting having largely reduced hot-crack, wherein the alloy contains 5.5 to 10% of Al, 0.3 to 2% of Zn, 0.1 to 0.4% of Bi or Sn, and 0.5% or less of Mn.

(8) USP 3,653,880 describes a Mg alloy having improved molten-flow performance and casting suitability, and adequate mechanical strength at about 100°C, wherein the alloy contains 3 to 10% of Al, 0.3 to 2% of Zn, 0.1 to 0.4% of Sn, and 0.5% or less of Mn.

(9) DE 1934617 describes a Mg alloy with reduced crack occurrence, wherein the alloy contains 3 to 30% of Al, 0.05 to 0.5% of Sn, 0.3 to 2% of Zn, and 0.5% or less of Mn.

(10) DE 1255978 describes a manufacturing of a Mg alloy powder by extrusion, wherein the alloy contains 13% or less of Al, 2.5% or less of Mn, 9% or less of Zn, and 16% or less of Sn.

(11) USP 5964965 describes a powder for use as a hydrogen storage alloy, the composition thereof being expressed with an equation $(M_{1-x}A_x)D_y$, wherein M is Mg or Be, or combination of them, and A is any of Li, Mn, and Zn, among others, and D is preferably Pd.

(12) Drits (IMV 2-1) (Journal) describes a Mg alloy which has a preferable combination of strength and plastic workability, wherein the alloy contains 15% of Al, 8% of Li, 0.4% of Mn, 1% of Zn, and 3% of Sn.

(13) Drits (Conference) describes a Mg alloy which has a preferable combination of strength and plastic workability, wherein said alloy contains 4.0 to 6.0% of Al, 7.0 to 9.0% of Li, 0.15 to 0.5% of Mn, and 0.8 to 2.0% of Zn, and 2.0 to 4.0%of Sn.

As seen in the foregoing, it is respectfully submitted that the aluminum content in the magnesium alloys in the above-listed references (1)-(8), (12) and (13) are all 10% or less; for this reason alone, it is respectfully submitted that these references (1) to (8), (12) and (13) would have neither taught nor would

have suggested the presently claimed casting alloy, including advantages thereof.

That is, as indicated previously, increasing the content of aluminum over 10% gives high strength, while proper addition of tin lowers the melting point which causes improved molten-flow performance of the alloy. This advantage of alloys according to the present invention would have neither been taught nor would have been suggested by the alloys of (1) to (8), (12) and (13) of the applied references as listed above, for the reason as given above.

Furthermore, it is respectfully submitted that the Mg alloy in above-listed reference (9) contains 0.05 to 0.5% of Sn; it is respectfully submitted that this reference would have neither taught nor would have suggested alloys as in the present invention, having more than 0.5% of tin (in particular, at least 1% of tin), and up to 10% of tin. The increased content of tin, as in the present claims, gives high tensile strength and lowers the melting point of the alloy, when properly combined with specific amounts of aluminum, providing improved molten-flow performance. It is respectfully submitted that the teachings of the applied prior art would have neither taught nor would have suggested the combination of amount of aluminum and tin as in the present claims, providing advantages in manufacturing by die casting and injection molding, as discussed in the foregoing.

The Mg alloy in the above-listed reference (10) is directed to manufacture of a powder of the alloy, and sintering thereof with extrusion. It is respectfully

submitted that this reference would have neither taught nor would have suggested an alloy composition as in the present claims, including amounts of aluminum, tin, zinc and rare-earth metal and advantages thereof.

The Mg alloy in the above-listed reference (11) does not contain aluminum. Such alloy clearly would have neither taught nor would have suggested the presently claimed Mg-based casting alloy; the alloy in reference (11) has a composition, and effect, completely different from alloys according to the present invention.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims remaining in the application are respectfully requested.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current Amendment. This marked-up version is on the attached pages, the first page of which is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the

filing of this paper, including extension of time fees, to the Deposit Account No. 01-2135 (Case No. 503.39364X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

Please delete the present Abstract, and substitute therefore the new Abstract set forth as an "APPENDIX" to this Amendment.

[ABSTRACT OF THE DISCLOSURE

An object of the present invention is to provide a high strength Mg based alloy and a Mg based casting alloy having a good fluidity and a good mechanical property, and a molded article using the alloy.

A high strength Mg based alloy, which contains 12 to 20% of Al by weight, 0.1 to 10% of Zn; 0.1 to 15% of Sn; and 0.05 to 1.5% of Mn.]

ABSTRACT OF THE DISCLOSURE

An object of the present invention is to provide a high strength Mg based alloy and a Mg based casting alloy having a good fluidity and a good mechanical property, and a molded article using the alloy. A high strength Mg based alloy, which contains, by weight, 12 to 20% of Al, 0.1 to 10% of Zn; 0.1 to 15% of Sn; and 0.05 to 1.5% of Mn.

IN THE CLAIMS

Please amend the claims presently in the application as follows:

1. (Amended) A high strength Mg based casting alloy, which contains, by weight, more than 10%, and up [2] to 20%, of Al [by weight]; 0.1 to 10% of Zn; [0.1] more than 0.5%, and up to 15%, of Sn; and 0.05 to 1.5% of Mn.

2. (Amended) A high strength Mg based casting alloy, which contains, by weight, more than 10%, and up [2] to 20%, of Al [by weight]; 0.1 to 10% of Zn; [0.1] more than 0.5%, and up to [15] 10%, of Sn; and 0.05 to 1.5% of Mn, and has crystal size of 10 to 300μm.

3. (Amended) A high strength Mg based casting alloy, which contains, by weight, 18 to 20% of Al [by weight]; 0.1 to 5% of Zn; [0.1] more than 0.5%, and up to 10%, of Sn; and less than 1.5% of Mn, and has a tensile strength (x) at 20°C larger than 240 MPa; and an elongation (y) larger than 0.5% and at the same time larger than a value calculated by $y = -0.295x + 78$.

4. (Amended) A high strength Mg based casting alloy, which contains, by weight, 12 to 15% of Al [by weight]; 0.1 to 5% of Zn; 1 to 10% of

Sn; 0.1 to 0.5% of Mn, and the remainder contains Mg more than 75%.

5. (Amended) A high strength Mg based casting alloy, which contains, by weight, 12 to 15% of Al [by weight]; 0.1 to 5% of Zn; 1 to 10% of Sn; 0.1 to 0.5% of Mn; one kind or more than two kinds of elements selected from the group consisting of Ca, Si and [rear-earth] rare-earth elements of which the total content is less than 5%; at least one kind of element selected from the group consisting of Sr and Sb of which the total content is less than 1%; and the remainder which is consisting essentially of Mg.

6. (Amended) A Mg based casting alloy, which contains, by weight, [2] 12 to 20% of Al [by weight]; and [0.1] more than 0.5%, and up to [15] 10%, of Sn.

7. (Amended) A Mg based casting alloy, which contains, by weight, 2 to 20% of Al [by weight]; [0.1] more than 0.5%, and up to 10%, of Sn; and less than 1.5% of Mn.

8. (Amended) A high strength Mg based casting alloy, which contains, by weight, 10 to 15% of Al [by weight]; 0.5 to 3% of Sn; 1.5 to 4.5% of Sn; 0.05 to 0.5% of Mn; and the remainder which is consisting essentially of

Mg.

9. (Amended) A high strength Mg based alloy according to any one of claims 1 to 4, which contains one kind or more than two kinds of elements selected from the group consisting of Ca, Si and [rear-earth] <u>rare-earth</u> elements of which the total content is less than 5% by weight; and at least one kind of element selected from the group consisting of Sr and Sb of which the total content is less than 1%.

10. (Amended) A Mg based casting alloy according to any one of claims 6 to 8, which contains one kind or more than two kinds of elements selected from the group consisting of Ca, Si and [rear-earth] <u>rare-earth</u> elements of which the total content is less than 5% by weight; and at least one kind of element selected from the group consisting of Sr and Sb of which the total content is less than 1%.

11. (Amended) A die cast article, which is molded using a molten metal of the alloy according to any one of claims 1 to [10] <u>8</u>.